Hubble Facts

HST Program Office

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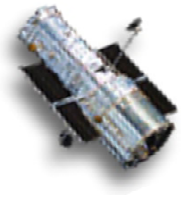


Hubble Space Telescope Archival Research (AR) Program

The HST Science Archive contains the data downlinked from the telescope during the execution of all accepted observing programs since launch (1990), ~ 12 TBytes at the current time. The HST Archive Research (AR) program was established to ensure that this immense wealth of scientific data is available to the entire astronomical community, and that the data can be "mined" to extract as much information as possible. Any HST image or spectrum potentially has additional value beyond that published by the original proposing team, and the archival research program encourages and enables follow-up research that is funded through a competitive selection process. Research with Hubble is notably analogous to medical research, in which the constant need for new laboratory studies is complemented by the re-analysis or synthesis of previously published data sets. Both kinds of research lead to major medical discoveries. The same has been true with Hubble research – studies requiring new observations and archival research continue to complement each other very effectively.

Current Requested Usage and Support of the AR Program

The HST AR program is a substantial one, and is currently funded at ~ 25% the level of the General Observer (GO) program. In comparison with lower funding at earlier times, the present level reflects the increased importance of research on an archive which is growing rapidly both in bytes and depth (via new instruments coming on-line). As is the case with the GOs, there is a high degree of over-subscription among the ARs: in recent times ~ 4x as many funds have been requested as are available, and ~ 3x as many proposals submitted as can be selected. This means not only that all accepted AR programs are considered excellent, but also that some very worthy proposals are rejected.

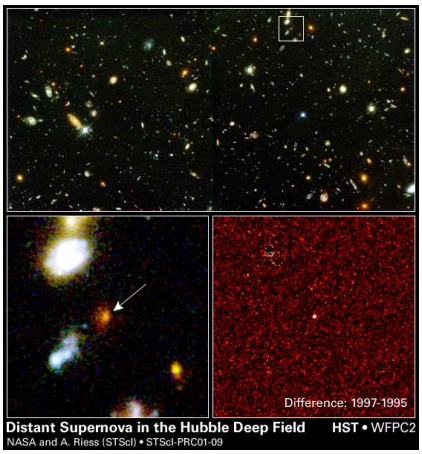
Historical Productivity of HST Archival Research

The Space Telescope Science Institute (STScI) maintains a database of all research papers published in the refereed literature, which utilize HST data. The fraction produced by all archival research to-date (i.e., since launch) is ~ 21%, and the post-2000 average is ~ 31%. The AR fraction of annual HST publication totals has in fact grown steadily since the early-1990s to the current levels in the mid-30s%. Clearly, archival research is an important part of the total HST research program, a status that will not change in the years ahead.

Reflecting the different nature of archival research vs. analysis of new data (cf. below), the fraction of all HST science news stories issued by the STScI, which are attributable to AR, is approximately 5%.

The Nature of HST Archival Research
HST archival research is multi-faceted and defies narrow classification. Many AR refereed papers focus on individual targets and utilize data from one or a small number of original GO programs. The possibilities range from re-analysis of GO-published data—with contrary results and findings—to other, rather different uses of the same data of the same object. Other AR programs are aimed more at synthesis, collecting datasets from many original programs in the analysis of classes of objects such as Seyfert galaxies, white dwarfs, infrared QSOs, rich stellar clusters in the LMC, and so on. In summary, and not surprisingly, there is no one-size-fits-all description of the nature of HST archival research.

A highly significant AR program result was the discovery by Riess et al. (2001, *ApJ*, **460**, 49-71) of a distant Type Ia supernova in archived NICMOS and WFPC2 imagery. The analysis helped confirm the acceleration of the universal expansion. Earlier HST observations of more moderate redshift SNIa's had strongly suggested—as a result of the SNe begin dimmer than expected—that the local universe was accelerating, but there were alternate explanations. Riess et al.'s more distant supernova (redshift z=1.7) refuted these alternatives and offered the first tantalizing observational evidence that gravity began slowing down the expansion of the universe after the big bang, and only later did the repulsive force of dark energy win out over gravity's attractive grip.



The Future of the AR Program
Demand for archival programs is currently increasing at a rate of ~10%/yr (for the last 3 proposal review cycles) and by the nominal end-of-mission in 2010, the archive will be > 3x the size of the current archive (by bytes). The ~35 to 40 TB of extraordinary-quality data that is expected in the archive in 2010 will contain numerous large, high information density datasets (e.g. Treasury, Large GO, Key Projects, Legacy AR products) containing a potential treasure-trove of scientific information and we can expect AR demand to increase steadily throughout the latter years of the HST mission and to be of great value to the astronomical community for many years beyond.